

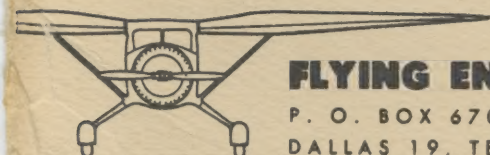
HANDBOOK
OF
OPERATION AND FLIGHT INSTRUCTIONS
FOR THE
MODELS YFM-1 AND YFM-1B MULTI-PLACE FIGHTER
AIRPLANES
AND
MODEL YFM-1A MULTI-PLACE FIGHTER
AIRPLANE

MANUFACTURED BY
BELL AIRCRAFT CORP.
BUFFALO, N. Y.



PUBLISHED BY AUTHORITY
OF
THE CHIEF OF THE AIR CORPS
BY THE
MATERIEL DIVISION
FIELD SERVICE SECTION
WRIGHT FIELD
DAYTON, OHIO

DECEMBER 20, 1940



HB-2

FLYING ENTERPRISES

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TECHNICAL ORDER No. 01-110HA-1

HANDBOOK OF INSTRUCTIONS

OF

OPERATION AND FLIGHT INSTRUCTIONS

FOR THE

MODELS YFM-1 AND YFM-1B MULTI-PLACE FIGHTER AIRPLANES

MANUFACTURED BY

BELL AIRCRAFT CORP.

BUFFALO, N. Y.

Cont. W535-AC 11722

Specification Type Y-604, Model Y-604-1

NOTE: These instructions affect safety of flying and a copy of this Technical Order will be placed in the Special Section of the Pilot's Information File prescribed by Air Corps Circular 45-7.



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FIELD SERVICE SECTION

WRIGHT FIELD

DAYTON, OHIO

JUNE 1, 1940

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FIG. 1 - 3/4 LEFT REAR VIEW OF COMPLETE AIRPLANE

SECTION IINTRODUCTION AND REFERENCES

1. This Technical Order is the Operation and Flight Instructions for the Models YFM-1 and YFM-1B Multi-Place Fighter Airplanes. Pilots and other personnel who are required to understand the operation of these airplanes will read and be familiar with the information contained herein.

2. Reference has been made in this Handbook to the following Technical Orders which contain applicable data and instructions:

T. O. No.	00-25-5	Procedure to be followed in Case of Fires During Flight
	01-1-60	Use of Flaps
	02-1-29	Ground Operation of Aircraft Engines
	02-5A-1	Operation & Flight Instructions - V-1710-11, -13, -21 & -23 Engines
	03-20BA-1	Operation & Flight Instructions - Propellers

SECTION IIDESCRIPTION1. Airplane.

a. General. - The YFM-1 and YFM-1B airplanes are mid-wing, monoplane, multi-place fighters, each powered by two Allison engines, driving pusher propellers. The YFM-1 airplane has type V-1710-23 engines and the YFM-1B has type V-1710-41 engines. The airplanes have the following overall dimension: Span 70 feet, length 45 feet 11-3/8 inches, and height 12 feet 5 inches.

b. Wing. - The wing is of the stressed skin, box type, all metal, cantilever, construction composed of center and two outer panels, each panel being made up of a box beam, a leading edge and a trailing edge. The wing tips are detachable. The balanced ailerons of the Frise type are constructed of aluminum alloy framework and fabric covering. Each aileron is fitted with a controllable trim tab. The flaps are of the split trailing edge type, built in two sections on each side of the airplane. They are operated by a manually or electrically controlled landing gear and flap power unit.

c. Empennage. - The horizontal and vertical stabilizers are of all metal construction attached in fixed alignment to the fuselage. The rudder and elevators are of the fabric covered type, dynamically and approximately statically balanced and equipped with trim tabs controllable from the cockpit.

d. Fuselage. - The fuselage is composed of nose and tail sections joined at the wing front beam. The tail section is of semi-monocoque construction. Both sections are constructed of frames and bulkheads supported by two longitudinal beams and stiffened by stringers. A Plexiglas enclosed cabin extends from the nose of the fuselage to aft of the navigator's station. A flat laminated shatter-proof plate glass windshield section is provided at the nose of the fuselage in front of the pilot.

e. Landing Gear. - The two main wheels and tail wheel are fully retractable. The main wheels are equipped with 39" diameter smooth contour tires and hydraulic brakes. The tail wheel assembly includes a shock strut and a 19" smooth contour tire and wheel swiveling through 360° and self-centering 45° each side of its longitudinal axis. A limit switch prevents the retraction of the landing gear except when the tail wheel is in its centered position. Retraction of the tail wheel is actuated by the manually and electrically driven landing gear and flap control unit. A spring loaded locking device keeps the wheel in centered position for TAKE OFF and LANDING.

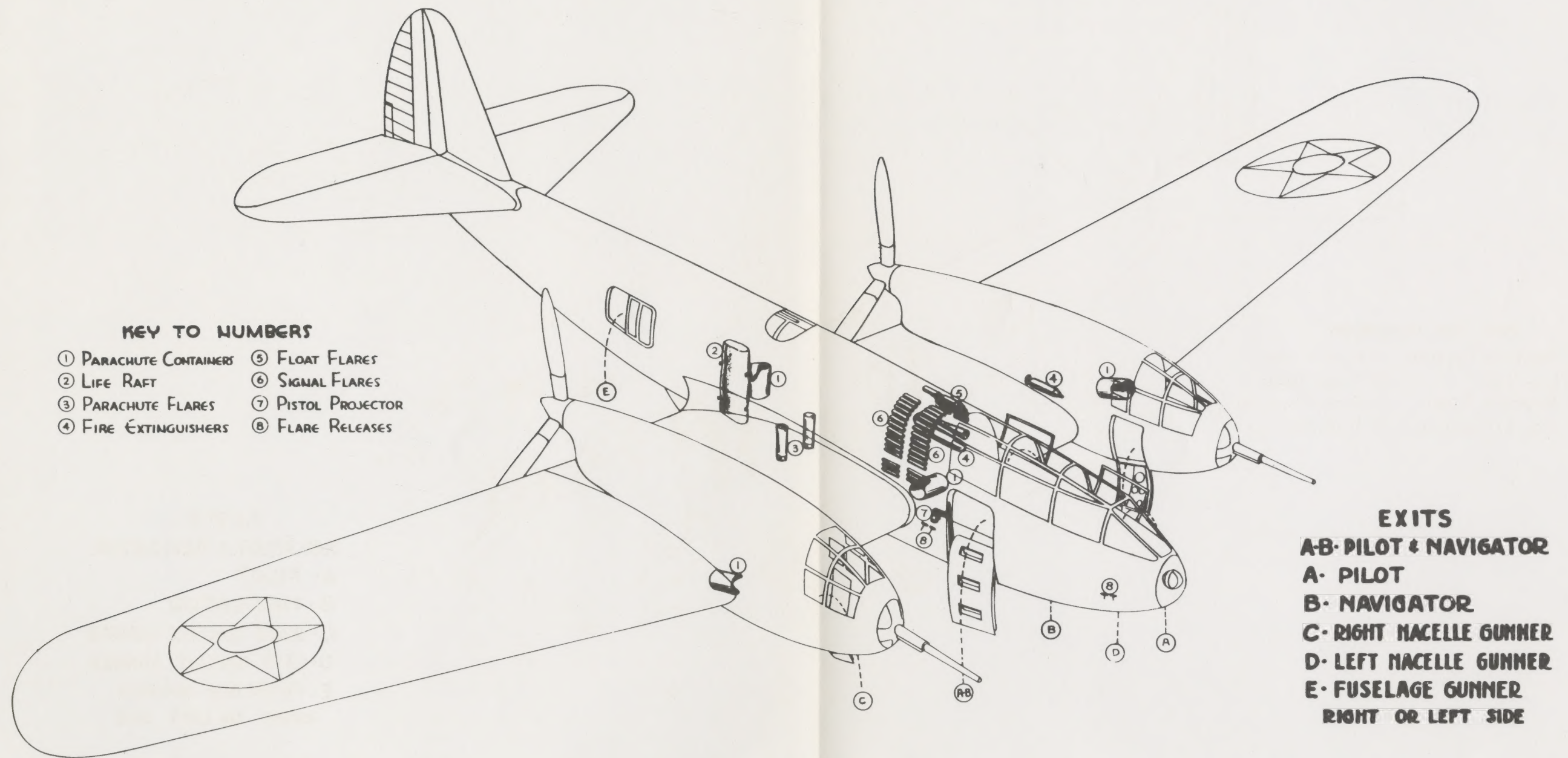


FIG. 2 - EMERGENCY EQUIPMENT & EXITS

2. Power Plant.

- a. Engines. - See Section V for description.
 - b. Auxiliary Engine. - The auxiliary engine is a 13.5 H.P., two-cylinder, gasoline engine, designed for a constant speed of 4,000 r.p.m.
 - c. Propellers. - The propellers are three-blade, constant speed, full feathering, automatic selective pitch, pusher type, controlled automatically or manually.
 - d. Oil System. - Oil for the main engines is carried in two 28-1/2 gallon tanks, one located aft of each engine. Cooling is provided by two oil coolers equipped with viscosity valves. Additional temperature control is provided by means of manually operated shutters located in the air outlet ducts. Oil dilution for winter flying conditions is provided.
 - e. Fuel System. - Fuel is carried in four tanks with a capacity of 200 gallons each. The two main tanks are on either side of fuselage in the center section of the wing and the auxiliary tanks in the outer panels, outboard of each nacelle. A stand pipe in the left hand main fuel tank insures 20 gallons of fuel for the auxiliary engine. This fuel is in addition to the normal supply and does not register on the fuel level indicator as it is not available for operation of the main engines. See Fuel System Diagram, Figure 3.
- ## 3. Equipment.
- a. Flight Controls. - Dual wheel-column-stirrup flight controls are provided. A tab control unit is located convenient to each pilot.
 - b. Electrical System. - A model 3718RX Eclipse, single voltage generator delivering 175 amperes at 4,000 r.p.m. is driven by the auxiliary engine. A 50 ampere, 24 volt, direct current generator driven by the right hand engine is arranged to operate in parallel with the main generator, thus providing an emergency source of power supply in event of failure of auxiliary engine or generator. Two type C-5 batteries are provided. Power for Autosyn instruments is obtained from a vibrator type converter or from the dynamotor which is an alternate source of power.
 - c. Fuselage Equipment. - (1) Pilot's Seat: The pilot's seat has a lever on the right side to permit vertical adjustment. The seat back cushion is the pilot's life preserver.

(2) Navigator's Seat: The navigator's seat is designed to permit fore and aft movement from the navigator's station to the co-pilot's station, controlled by a lever on the right side. Vertical adjustment is controlled by a lever on the left side. The seat back cushion is the navigator's life preserver.

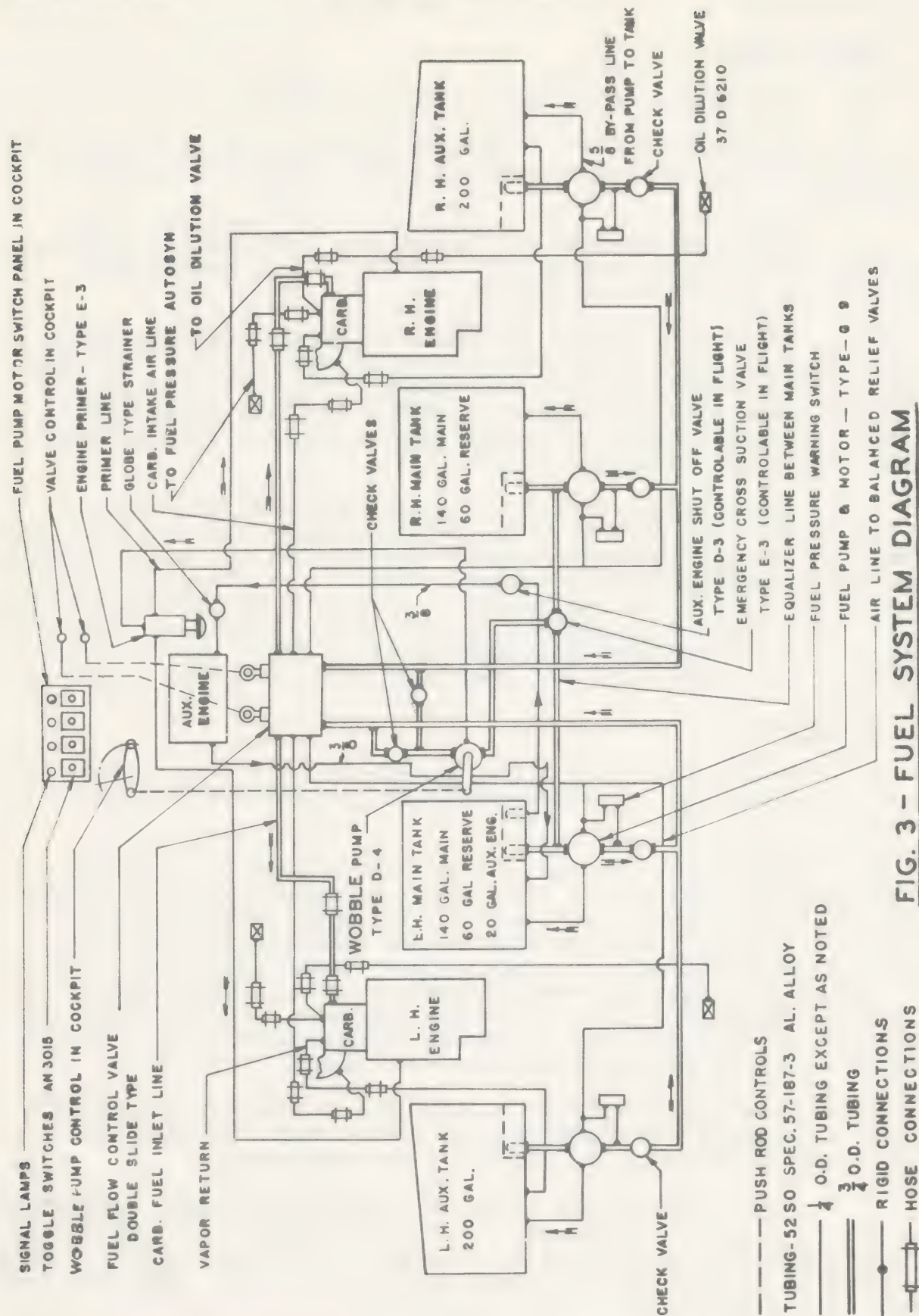


FIG. 3 - FUEL SYSTEM DIAGRAM

(3) Fuselage Gunner's Seat: The fuselage gunner's bench hinges on the right side and folds upward to stowed position. A release lever is located on the left side. A canvas seat back on the left side of the airplane is removable and is stowed on the right side. The seat cushion is the gunner's life preserver.

(4) Nacelle Gunner's Seat: The nacelle gunners are provided with folding canvas seats which are stowed in vertical position on front side of engine firewall. The seat cushion constitutes the nacelle gunner's life preserver.

(5) Emergency Equipment and Exits: (a) General: The emergency equipment and exits are illustrated in Figure 2.

(b) Parachutes: All crew members use the detachable type parachute except the pilot who uses the seat pack type.

(c) Emergency Exits: Fall-away sections on the left side of the fuselage cabin enclosure at both pilot's and navigator's stations provide emergency exits. Releases for these sections are located at the top center of each. The fuselage gunner's emergency exit is by means of either side gun turret. The entrance doors on each nacelle constitute the nacelle gunner's exits.

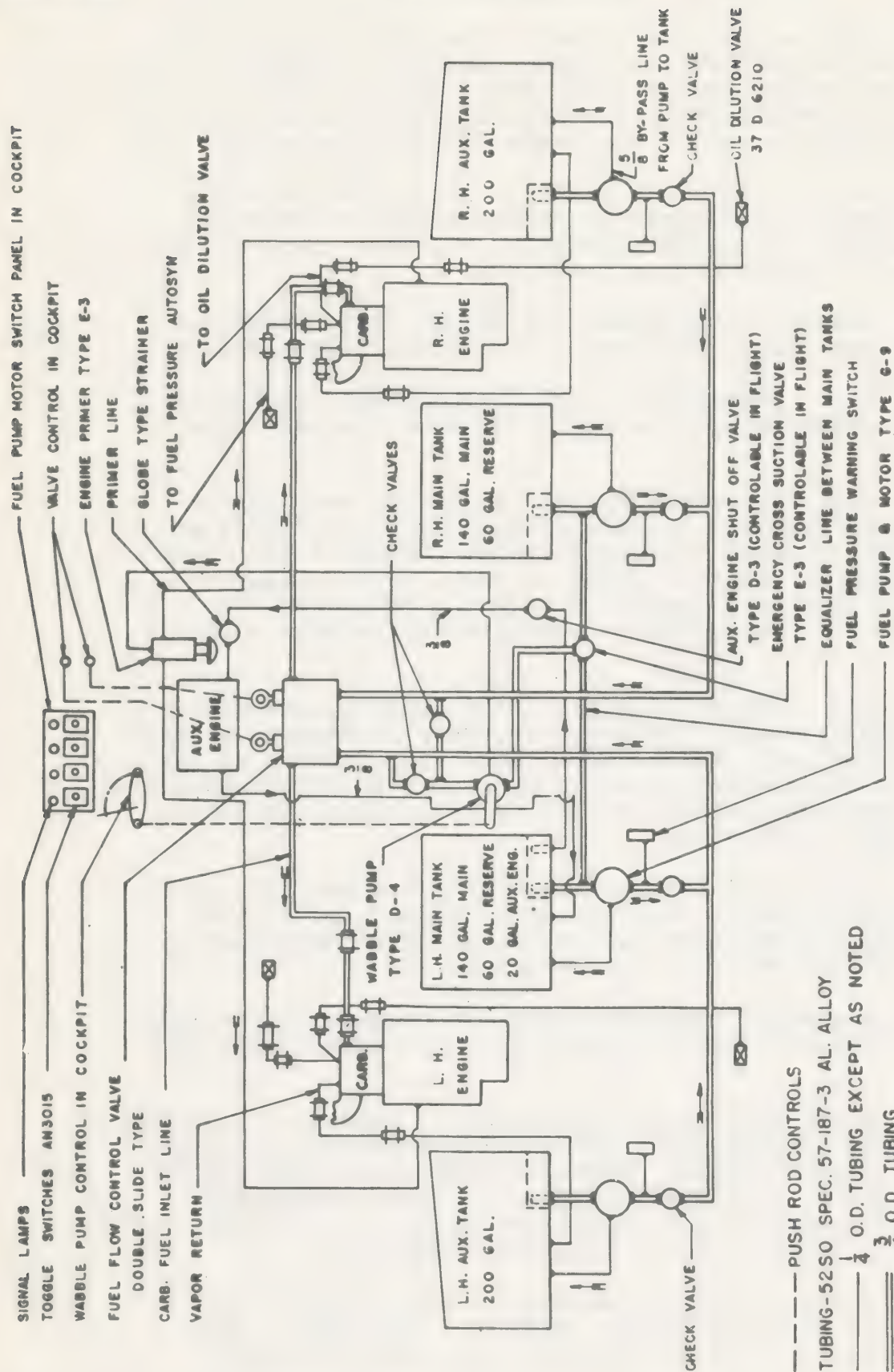
(d) Flotation Gear: Four compartments within each wing outer panel provide flotation in event of emergency water landing. Vent and bilge lines run from these compartments to the top outboard side of each nacelle. A bilge pump carried in the fuselage over the bomb compartment should be used at each bilge connection after emergency landing on water.

(e) Life Raft: A type A-2 five-man life raft complete with CO₂ cylinder is carried on the right side of the fuselage aft of the top gun turret. Inflation is accomplished by manual operation of the valve on the raft itself.

(6) Baggage: Adequate space for baggage is provided in the fuselage below the floor, forward of the bottom turret gun compartment.

d. Heating and Ventilating Equipment. - Warm air is brought to each crew station through ducts from a heater muff around the exhaust manifold of each engine. Butterfly valves at each station control the warm air to suit requirements. Pilot's, navigator's, and nacelle gunner's station are ventilated by means of sliding Plexiglas panels in either side of the cabin enclosure.

e. Fire extinguishing Equipment. - A pressure type CO₂ fire extinguisher is provided for the engines. One type A-14₂ extinguisher and one type A-2 extinguisher are also provided.



- PUSH ROD CONTROLS
- TUBING-5250 SPEC. 57-187-3 AL. ALLOY
- 1/4" O.D. TUBING EXCEPT AS NOTED
- 3/4" O.D. TUBING
- RIGID CONNECTIONS
- HOSE CONNECTIONS

FIG. 3A - FUEL SYSTEM DIAGRAM - YFM-1B AIRPLANE

f. Communications Equipment. - A type SCR-261 Command Set is provided and an antenna loop is installed in a Plexiglas enclosure in the nose of the airplane. A fixed antenna runs from the top of the forward section of the fuselage to the top of the fin. The airplane is equipped with a 5-place interphone system with units located on right side of each station.

g. Oxygen Equipment. - The oxygen equipment consists of one Type E-1 oxygen bottle and one Type A-6 regulator for each station.

h. Bombing Equipment. - Twenty type T-5 or type M-5 bombs are carried in the fuselage between the front and rear beams of the wing center section. Bomb compartment doors are the manually operated type.

i. Gunnery Equipment. - (1) Nacelle Guns: Each nacelle accommodates one Colt 37mm automatic cannon operated by electric motors and controlled locally by electric hand control or from an electric fire control box at the navigator's station. The trigger is located on the hand control box. Selection of control is obtained through a distributing switch in each nacelle. The cannon is limited to an effective 25° cone of fire by limit switches provided. Eleven ammunition boxes, each containing two clips of five rounds, are located in the gunner's station of each nacelle. When fixed gun firing position is preferred the guns may be set manually by removing the hand crank from the distributing switch and inserting it on the aft ends of azimuth and elevation motors. Removal of 37mm cannon allows installation of type H-2 gun cameras.

(2) Fuselage Top Turret Gun: The 30 cal. type M-2 machine gun rides in a retractable 360° full swiveling turret located on the top of the fuselage just forward of the trailing edge of the wing. The gun is of the shoulder firing type and will elevate to a straight up position. A stop prevents firing into the pusher propellers. The turret is lowered and elevated by means of a crank on the left side of the fuselage. Five L-4 ammunition boxes containing 500 rounds of 30 cal. ammunition are located on the right side of the fuselage at approximately the center of the station.

(3) Fuselage Side Turret Guns: The side turret gun installations, located on both sides of the fuselage between the wing and the tail, each consist of a manually retracted turret, a door hinging aft and inboard, a 50 cal. Type M-2 machine gun mounted in a shoulder fire adapter and 1200 rounds of ammunition in ammunition boxes at the side of the fuselage ahead of each turret. Just above and aft of these ammunition boxes is a crank for extending and retracting the turret. At the bottom of the splined post is a handle lock for vertical adjustment of the gun mount and midway on the gun support arm is a lock release for rotational adjustment. The guns are held in stowed position by clips located on the floor on either side of the station.

(4) Fuselage Bottom Turret Gun: The bottom turret gun installation consists of one 30 cal. Type M-2 machine gun mounted in a type C-12 flexible gun adapter and a 180° turret located in the belly of the fuselage just forward of the side turret gun station. A turret rotation release is located on the left-hand side of the station. Five type L-4 ammunition boxes containing 500 rounds of 30 cal. ammunition are provided on the gunner's left as he faces aft.

j. Pyrotechnic Equipment. - A Type M-2 signal pistol, 15 white flares, and 15 red flares are located at the right side of the navigator. Two type M-8 flares, installed in type A-4 racks located aft of rear beam at gunner's floor, are controlled by two manually operated handles on the right side of the floor of the pilot's compartment, and two handles on the right side of the navigator's compartment.

SECTION IIIGENERAL INSTRUCTIONS

1. Location of Controls. - For location of controls, refer to Figures 3 to 7 inclusive.

2. Operation of Controls.

a. Flight Controls. - (1) General: Operation of the dual controls is conventional.

(2) Co-pilot's Control Column: The co-pilot's control column is stowed at the left side of the fuselage; to bring column into use, detach from stowage clip and rotate forward into position.

(3) Rudder Pedals: (a) The co-pilot's rudder pedals are stowed beneath the floor when not in use; to use open doors and move pedals into position.

(b) To adjust either the pilot's or co-pilot's pedals press forward on the lever located on the outer side of each pedal allowing the pedals to move forward. To return insert to under pedals and pull back. The pedals may be locked in five positions.

(4) Trim Tab: One trim tab control unit is located at the left of the pilot and one at the left of the co-pilot.

NOTE: The trim tabs are to be used only for trimming, not for balancing.

(5) Flaps: Operation of the flaps is described in paragraph b., below. Refer also to T. O. No. 01-1-60.

b. Landing Gear Controls. - (1) General: Figure 7, clearly illustrates the landing gear and flap control box which includes the tail wheel lock.

(2) Landing: Turn selector switch to "LAND". The landing gear will extend first, as shown by the landing gear indicator on the control box. When the landing gear is completely extended, the flaps will extend automatically to 40 degrees down. Any degree of flap deflection may be selected, however, by moving master switch to "OFF" position when flaps are at the desired deflection. This may be done as soon as the landing gear warning horn indicates that the wheels are down. When the master switch is moved to the "ON" position, the flaps will continue down.

(3) Take Off: Upon landing, rotate selector switch to "TAKE OFF" position to retract flaps. This operation engages a brake on the landing gear, eliminating possibility of wheel retraction while airplane is on the ground.

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T. O. NO. 01-110HA-1



FIG. 4 - PILOT'S COCKPIT ARRANGEMENT & CONTROLS-LEFT SIDE

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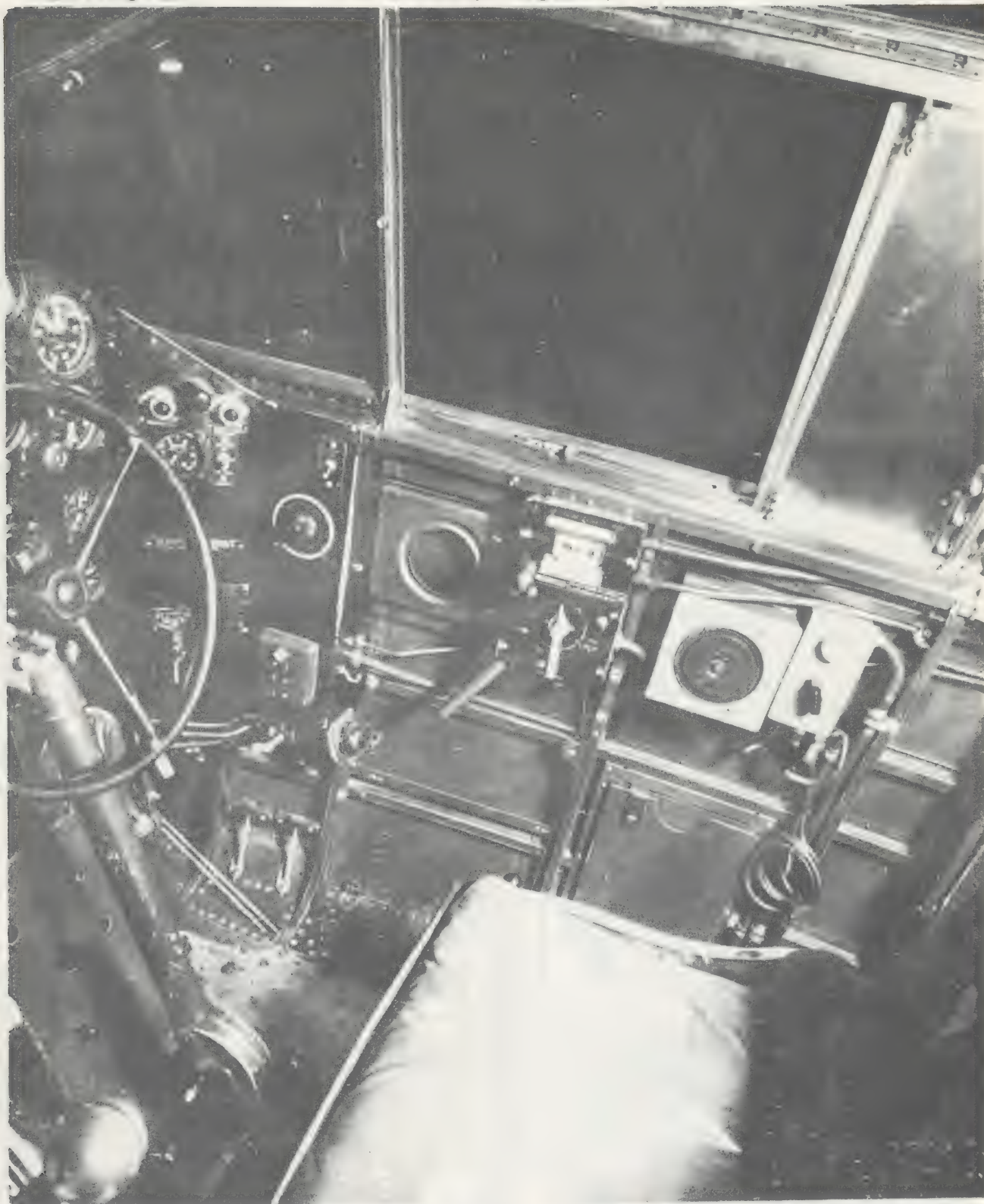


FIG. 5 - PILOT'S COCKPIT ARRANGEMENT & CONTROLS - RIGHT SIDE

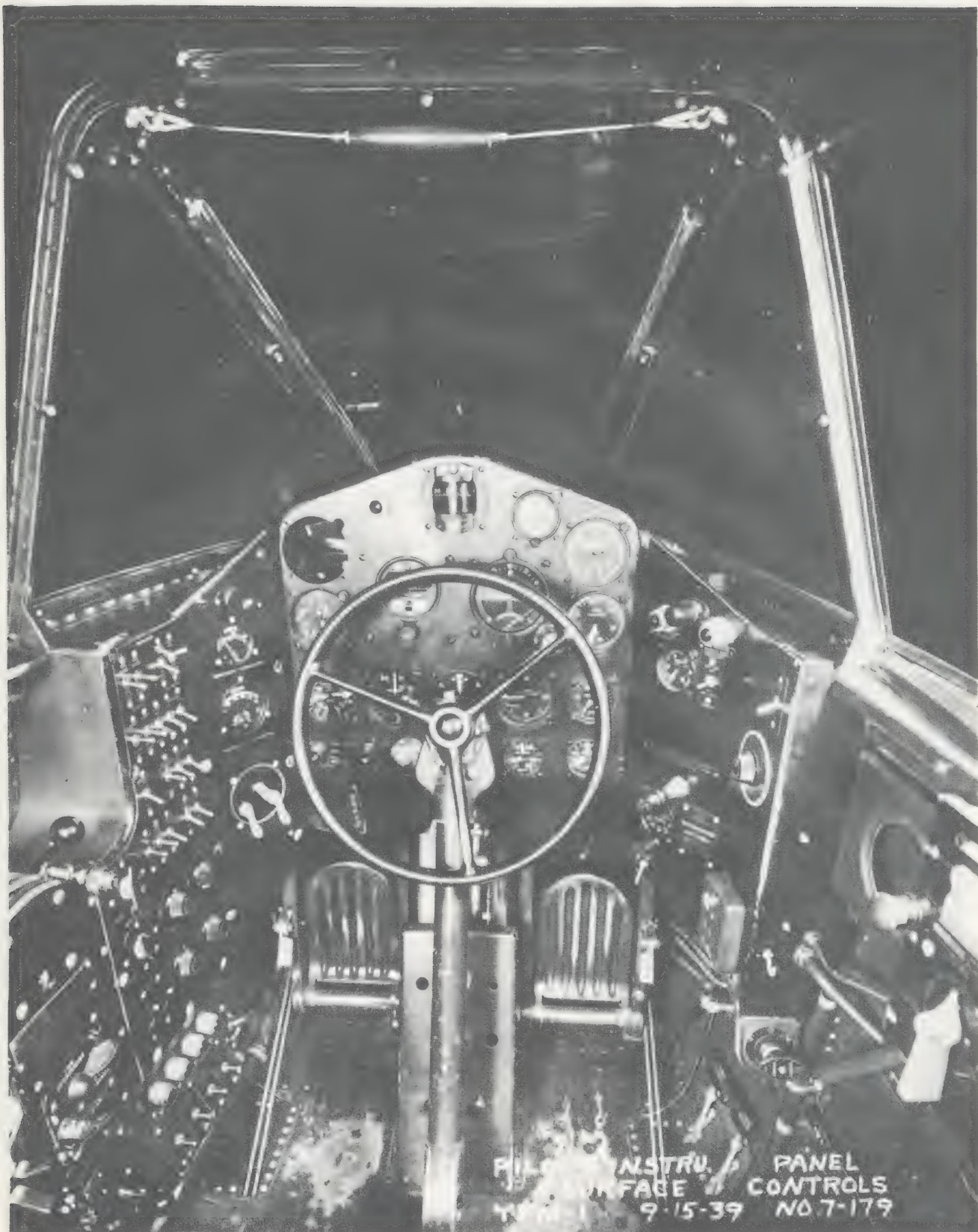


FIG. 6 - PILOT'S COCKPIT ARRANGEMENT & CONTROLS - CENTER

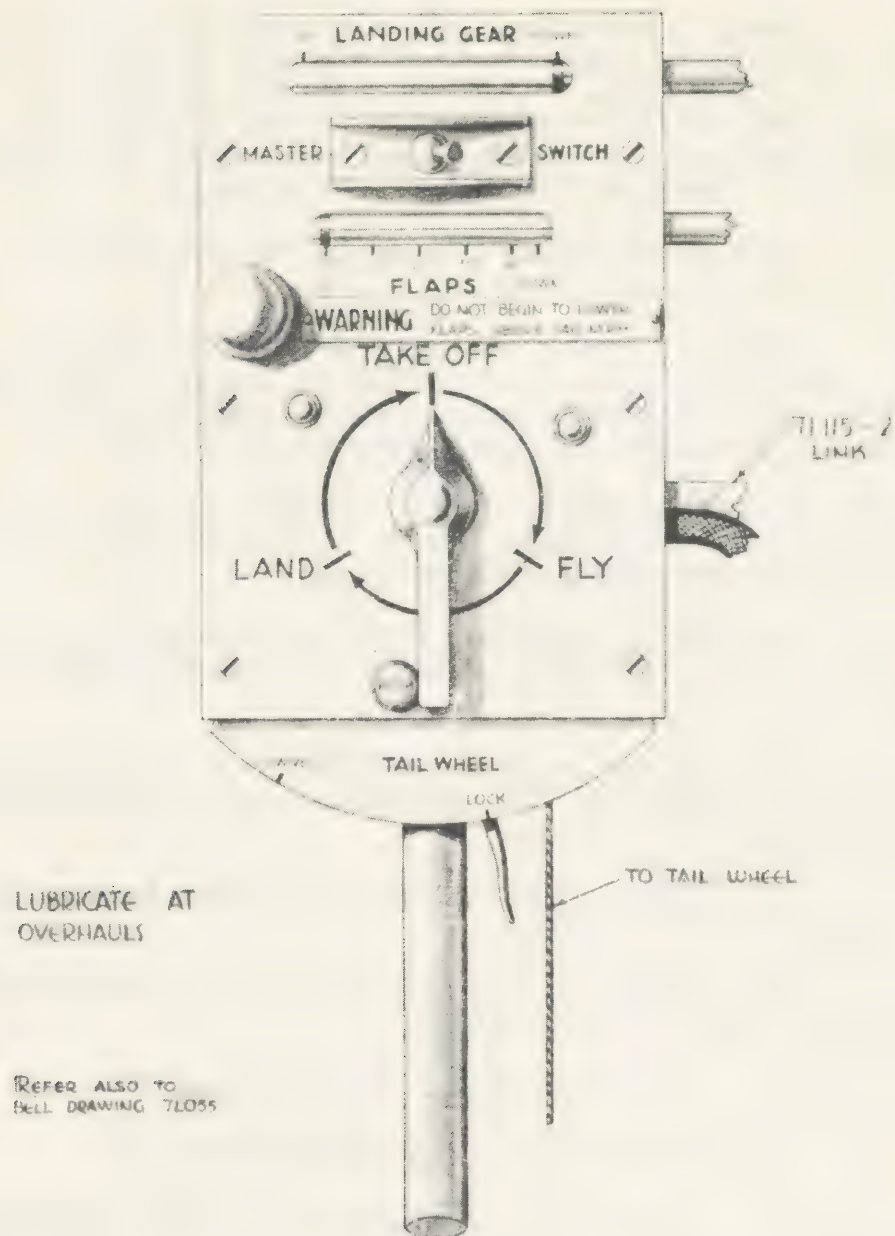


FIG. 7 - LANDING GEAR & FLAP CONTROL BOX

(4) Fly: After take-off, the landing gear is retracted by moving selector switch to "FLY" position.

NOTE: Master Switch should be in "ON" position at all times during operation of the airplane except in condition explained in (2), above.

(5) Manual Operation: To manually extend the landing gear and flaps insert hand crank into slow speed socket, in the center of the carry-thru deck. Crank until high handle loads have been eliminated, then shift to high speed socket and proceed until landing gear and flaps are extended. The high speed socket will lower the gear three times as fast as the slow speed socket.

(6) Tail Wheel Lock: Place in "Lock" position for landing and take-off.

(7) Brakes: Brake controls are incorporated in the rudder pedals. The parking brake, located in front of the pilot at the lower edge of the instrument panel may be engaged when pedals are depressed and disengaged by again depressing pedals.

c. Power Plant Controls. - (1) General: For complete operation and flight instructions, see T. O. No. 02-5A-1. T. O. No. 02-1-29 also contains essential instructions.

(2) Starting: Starting will be accomplished in accordance with T. O. No. 02-5A-1, except for the following special instructions:

(a) Place master ignition switch in center of main engine ignition switch in "ON" position, and start auxiliary engine as per paragraph (7) below.

(b) Place engine selector valve handle in "ON" position for engine to be started.

(c) Place mixture control handle of engine to be started in "IDLE CUT-OFF" position.

(d) Turn on autosyn dynamotor.

(e) Check fuel quantity indicator.

(f) Place fuel pump switch of tank desired to "ON" position. Left main tank should be used for starting left engine and right main tank for right engine. If the engine is to be started from tank on opposite side of airplane both fuel selector valves must be placed in "CROSS FEED" position and mixture control lever of engine not running placed in "IDLE CUT-OFF" position to prevent electric driven fuel pumps from flooding engines.

(g) Prime engine to be started two to four times if engine is cold, otherwise no priming is necessary.

(h) As starter is meshed, throw mixture control lever into "RICH" position. No wobble pump operation is necessary with electric driven fuel pumps.

(i) If engine does not start, return to "IDLE" CUT-OFF" position immediately to prevent flooding.

(j) If engine floods, repeat starting operation as above, but leave mixture lever in "IDLE CUT-OFF" position until engine catches. Then place in "RICH" position.

(3) Stopping: The engines will be stopped in accordance with T. O. No. 02-1-29.

(4) Fuel System. - The fuel system control panel consisting of an "OFF" and "ON" switch, a test switch and a fuel pressure signal lamp for each of the four electrically driven fuel pumps is located on the left side of the pilot's cockpit. A fuel reserve lamp which indicates when the reserve fuel is being used is located below the fuel level indicator on the left side of the main instrument panel. The mixture control incorporates the "IDLE CUT-OFF" for emergency stoppage of engines. The primer is located on the pilot's right. Tanks are selected by switches on pilot's left. Engine selector valves are operated by handles at pilot's left. Fuel equalization is obtained by operation of the cross suction valve on the fuel equalization line on the floor at the gunner's station.

(5) Supercharger Regulator in the YFM-1 Airplane: A Type A-7A supercharger regulator is installed for each supercharger. The regulator line is attached to the exhaust manifold to eliminate surging. Because of this, the supercharger control handles in the cockpit must be pulled back as the airplane gains altitude to prevent excessive boost.

(6) Propeller: (a) General: Operating instructions for the propeller are contained in T. O. No. 03-20BA-1. When controlled automatically, a predetermined engine speed is held constant by means of a governor set by the propeller control on the throttle quadrant. When controlled by manual selection, the blade angle may be varied by operation of the increase or decrease r.p.m. switch independently of the governor. Emergency fast feathering is assured by a separate switch on the pilot's electric panel which applies, through means of a voltage booster, an increased voltage of approximately three to one to the propeller motors causing the propellers to feather in 6 to 8 seconds. The markings on the propeller control are approximate and the desired r.p.m. should be obtained by relying on the tachometer.

(b) For automatic constant speed control throw switches to automatic and set propeller controls as follows:

1. For Take Off: Set propeller controls on throttle quadrant to 2950 r.p.m.

2. During Flight: Set propeller controls on throttle quadrant to desired r.p.m.

3. For Landing: Set propeller controls on throttle quadrant for 2,000 to 2,400 r.p.m. The speed should be sufficiently below take-off r.p.m. to prevent overspeeding of the engine in case a sudden burst of power is applied.

(c) For Manual Control: Throw switches to "MANUAL" and operate switches marked "INCREASE AND DECREASE R.P.M."

(d) For Feathering: Move red control switches to forward position marked "FEATHER".

(7) Auxiliary Engine: (a) To operate auxiliary engine place fuel valve located at rear of wing carry-thru on right side of airplane in "ON" position.

(b) Move auxiliary engine ignition switch on co-pilot's panel to "BOTH". This switch is safetied thru the main ignition switch.

(c) Move "Start - Generate" switch to "START" position until engine starts - then release.

(d) Move ignition switch to "IDLE" for warm up period -- then back to "BOTH".

(e) To stop engine move ignition switch to "OFF" position.

d. Other Controls. - (1) Master and Ignition Switches: These switches are clearly marked on the pilot's electrical control panel. The master switch is located above the left and right engine ignition switches and other than controlling the ignition, this master switch also controls all those circuits that are safetied through it, namely, the starter circuits, the pitot heater circuit, the fuel pressure warning circuits, the auxiliary engine ignition and fuel pump electrical circuit. This switch should always be thrown to "OFF" position before leaving the airplane.

(2) Pitot Heater: A switch on the pilot's electrical panel controls the heating element in the pitot tube.

(3) Warning Bell: Warning Bells at each crew station are operated by a switch on the pilot's control panel.

(4) Ice Eliminating Equipment: A motor operating the de-icer distributing valve is controlled by a switch on the pilot's right auxiliary panel. This panel also contains a double pole switch controlling motors on the vacuum pumps. The propeller anti-icer system control is on the pilot's right panel.

(5) Fire Extinguishing Equipment: (a) Engine Extinguisher: One type A-12 CO₂ extinguisher is mounted in the forward part of the fuselage under the floor. Control pull and selector valve are located on left side of pilot's electrical panel.

(b) Hand Extinguishers: One type A-14 extinguisher is located in the fuselage above the wing crawlway to the left rear of the navigator. One type A-2 extinguisher is located in the left landing gear wheel well, accessible from the ground. Refer to T. O. No. 00-25-5 for procedure to be followed in case of fire during flight.

(6) Oxygen Equipment: The pilot's regulator is situated in the right lower corner of the instrument panel. The co-pilot's regulator is readily accessible on the left. The fuselage gunner's regulator is on the right side; the nacelle gunner's regulators are conveniently located.

(7) Armament: (a) Operation sequence for the top turret gun is as follows:

1. Remove turret slot cover
2. Release gun barrel from spring clip by rotating gun barrel upward.
3. Unlatch gun mount by pressing lever at butt end of gun mount, and fold gun down inside of turret.
4. Extend turret by operating hand crank on left side of airplane.
5. Extend gun through turret slot and latch gun mount by engaging the taper pin. Top hole for operating position, bottom hole for stowed position.

(b) Operation Sequence for the two .50 caliber side turret guns is as follows:

1. Release catch.
2. Extend the turret by operating the turret retraction and extension crank.
3. Remove the gun barrel from stowage clip.

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- holding clip provided.
4. Swing turret door inboard and aft to
 5. Release vertical adjustment of opposite lock by turning handle and raise opposite gun mount to the top position.
 6. Release rotation lock and swing gun forward and up.
 7. Release vertical adjustment and raise gun.

(c) To operate the 30 caliber belly turret gun, pull turret release lock and rotate turret to top locked position. Break gun from stowage clip and swing into firing position.

SECTION IVSPECIAL INSTRUCTIONS

1. Flight Limitations.

a. Maneuvers Prohibited.

Loop
Roll
Immelmann
Inverted Flight
Spin

b. Other Restrictions. - (1) Do not exceed a speed equal to the indicated high speed times 1.225.

(2) Do not exceed an indicated air speed of 140 M.P.H. with flaps down.

(3) Do not subject the airplane to load factors in excess of those listed below.

(a) Preliminary - positive 3.4

negative .3

(b) Final - positive 5.6

negative 1.6

2. Engine Cooling System. - The engines should not be allowed to idle for a long period of time on the ground as the cooling system is designed for efficient cooling in flight only. Maximum allowable temperature of prestone before take-off is 125°C. (257°F.)

3. Landing Gear. - The pilot should be thoroughly familiar with the operation of the landing gear. When the airplane is on the ground the selector switch should be either on "LAND" or "TAKE-OFF" before operating the landing gear and flap control master switch.

4. Warning. - Due to close proximity of propeller to tail surfaces, a sudden reduction of power of one engine either through an engine failure or excessive movement of one throttle will result in a much more violent and immediate control reaction than on multi engine tractor type airplanes. Failure of one engine may result in a spin unless the other engine is retarded or trim tab control adjusted immediately. In case of failure of one engine the other engine should be retarded immediately and the throttle of good engine advanced gradually as trim tab control is adjusted to counteract turning moment. With proper adjustment of trim tab, airplanes can be safely flown on one engine. Single engine practice flights will not be engaged in below ten thousand feet. This airplane should be flown only by experienced multi engine pilots.

SECTION VPOWER PLANT

1. Engine.

a. General. - Each YFM-1 and YFM-1B airplane is powered with two Allison, prestone cooled, Vee type engines driving three-bladed pusher propellers through extension shafts. The engines are normally operated on 100 octane fuel and have a compression ratio of 6.65:1 and a propeller reduction gear ratio of 2:1.

b. YFM-1 Airplane. - (1) General: The type V-1710-23 engines used in the YFM-1 airplane have type B-1 exhaust driven turbo superchargers in addition to the engine driven blowers which have a gear ratio of 6.26:1.

(2)	Ratings.	BHP	RPM
	Normal (Sea Level)	1000	2600
	Take-Off " "	1150	2950
	Military " "	1150	2950

c. YFM-1B Airplane. - (1) General: The V-1710-41 engines used in the YFM-1B airplane are similar to the type V-1710-23 except that the blower gear ratio is increased to 8.77:1 to obtain power at altitude without the necessity of incorporating a turbo-driven supercharger in addition to the engine blower.

(2)	Ratings.	BHP	RPM
	Normal (Sea Level)	960	2600
	Take-Off " "	1090	3000
	Military " "	1090	3000

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SECTION VI

FLYING CHARACTERISTICS

YFM-1B Airplane

1. Level Flight Speeds at Design Altitude of ft. with Design Gross Weight of 18,373 lb.

Maximum Speed	—	m. p. h. at	—	r. p. m. with	—	b. hp. (	—	% rated)
High Speed	at 12,600'	268*	m. p. h. at	2600	r. p. m. with	1920	b. hp. (	100 % rated)
Operating Speed	at 12,000 ± 240	m. p. h. at	2280	r. p. m. with	1440	b. hp. (	75	% rated)
Cruising Speed	at 12,000 ± 200	m. p. h. at	1900	r. p. m. with	960	b. hp. (	50	% rated)

2. Optimum Range and Endurance with 800 gal fuel and 0 lb. bombs.

At High Speed	1080	miles at	1.35	mi./gal. or	4.02	hrs. at	199	gal./hr. (s. f. c.)	.62
At Operating Speed	1700	miles at	2.13	mi./gal. or	7.10	hrs. at	113	gal./hr. (s. f. c.)	.47
At Cruising Speed	2180	miles at	2.73	mi./gal. or	10.9	hrs. at	73.5	gal./hr. (s. f. c.)	.46

3. Practical Range and Endurance with 800 gal. fuel and 0 lb. bombs.

At Operating Speed	1330	miles at	1.67	mi./gal. or	5.55	hrs. at	144	gal./hr. (s. f. c.)	.60
At Cruising Speed	1670	miles at	2.08	mi./gal. or	8.33	hrs. at	96	gal./hr. (s. f. c.)	.60

4. Climb Data with Gross Weight of 18,373 lb.

Standard Altitude	ft.	S.L.	5000	10,000	15,000	20,000	25,000	29,900
Climbing Speed	m. p. h.	120	130.5	141	150.5	157	163.5	169.5
Engine Speed	r. p. m.	2600	2600	2600	2600	2600	2600	2600
Total Power	b. hp.	1690	1780	1880	1720	1450	1200	—
Maximum Rate	f. p. m.	1520	1520	1520	1215	825	460	100
Minimum Time	min.	0	3.3	6.2	10.6	15.5	23.5	44.1

5. Ceiling: Normal Engine Operation: Service Ceiling 29,900 ft. Absolute Ceiling 31,300 ft.

6. Take-off and Landing Distances—To Clear 50 ft. Obstacle at Sea Level (no wind).

Take-off	1800	ft. at	90	m. p. h.	15	deg. flap.	Gr. Wt.	18,373 lb.	Ground run	1250	ft.
Land	1377	ft. at	77	m. p. h.	Full	deg. flap.	Gr. Wt.	18,373 lb.	Ground run	852	ft.

7. References and Remarks: This airplane may be expected to give approximately the above performance with given load under standard atmospheric conditions. Figures given may vary slightly from figures listed elsewhere in this Technical Order and other technical publications for this model of airplane.

*Temporary engine restrictions prohibit the attainment of this speed.

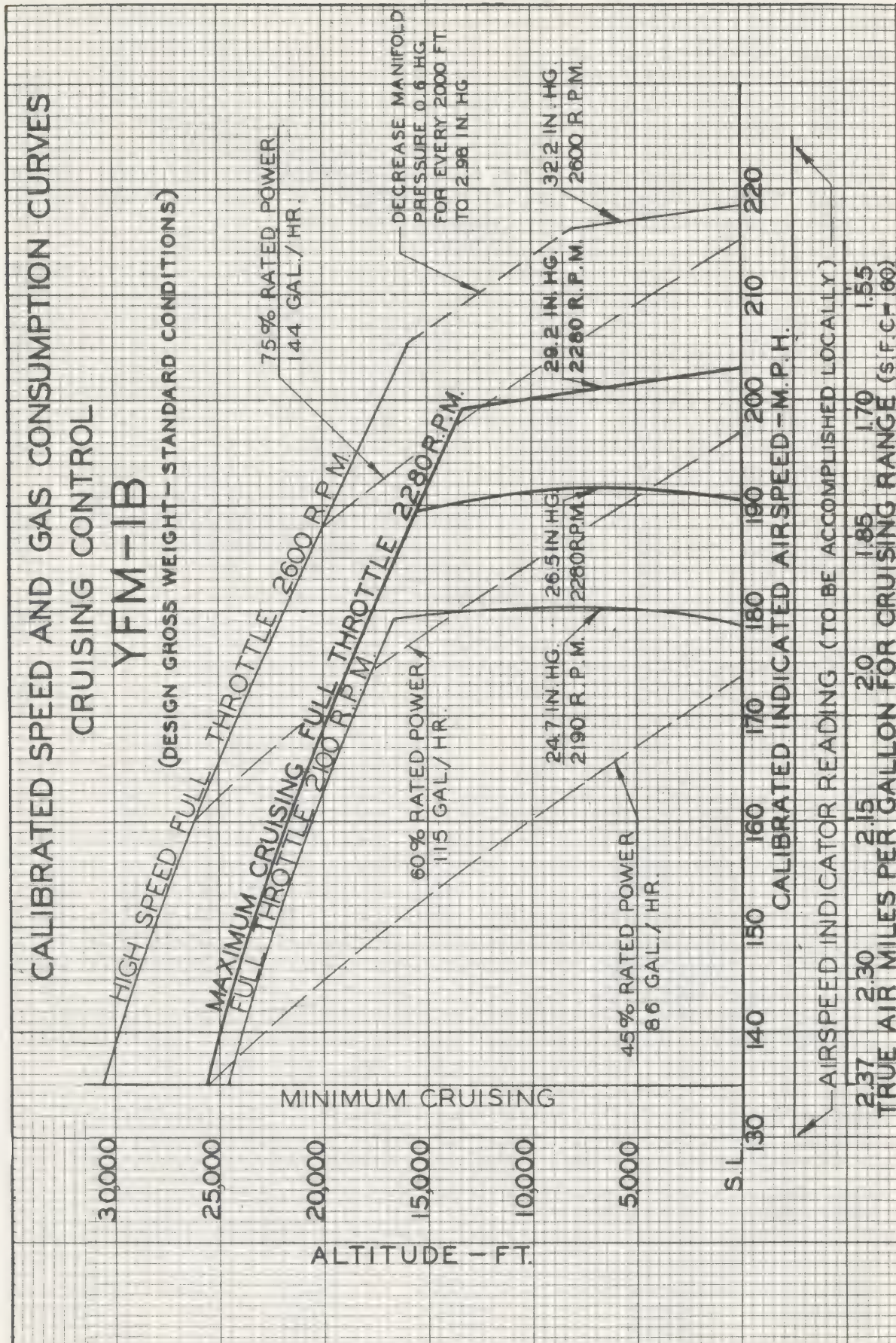
References: M.R's PHQ-M-19-1102-A, dated 6/22/40, and EXP-M-51/P642-32, dated 7/22/40

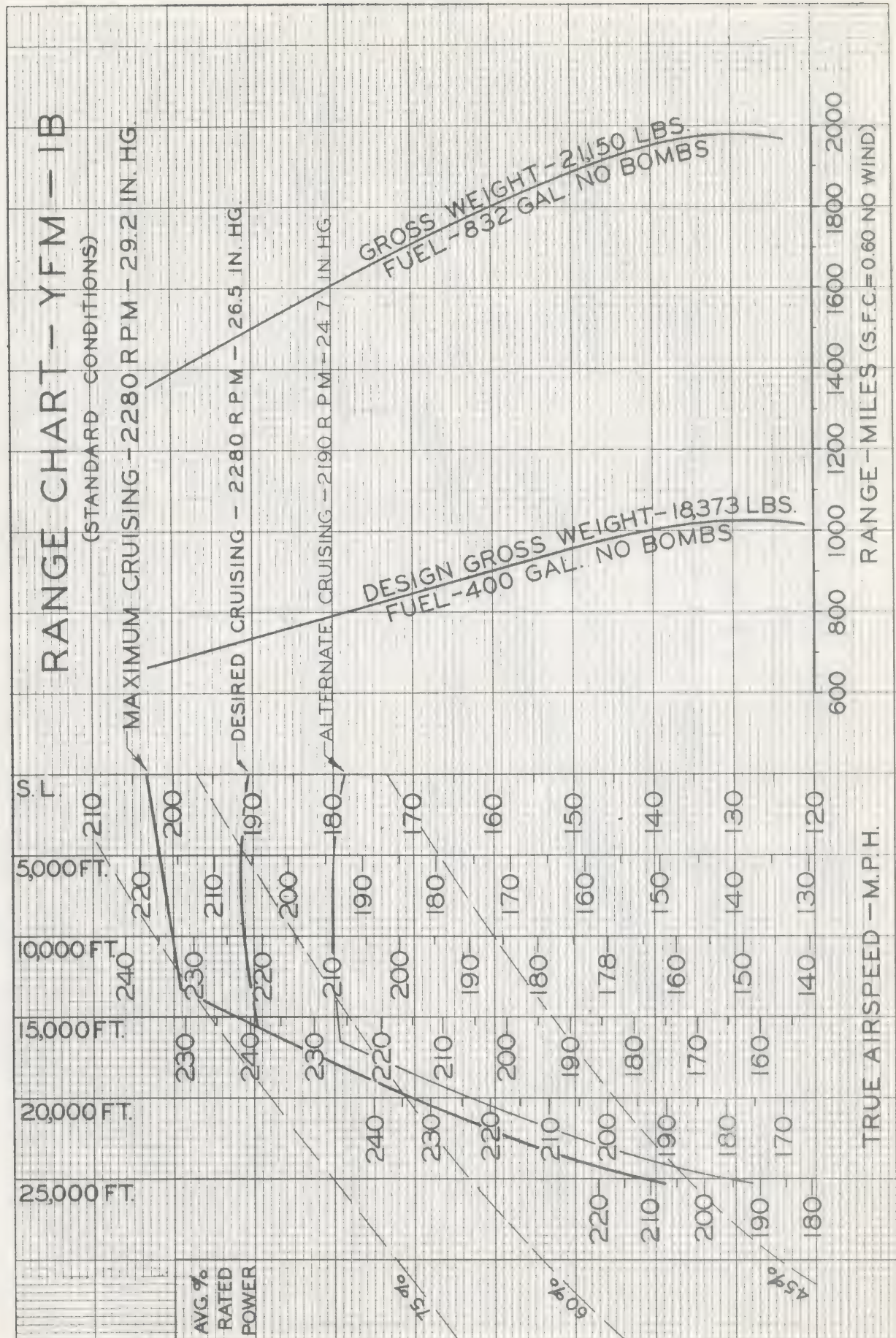
The airplane may be expected to give approximately the above performances with the weights as quoted herein.

Revised 12-5-40

SECTION VIIWEIGHT DATA

1. Weight in Pounds.	<u>Overload</u>	<u>Normal</u>
Weight Empty (Incl. Radio, Wiring, Conduits, Bomb Racks, etc.)		13,674
Useful Load		5,326
Crew - (5) at 200 lbs. each		1,000
Fuel - Normal - 400 Gal.		2,400
Fuel - (Overload - 400 Gal.)	2,400	
Oil - Normal - 28-1/2 Gal.)		214
(Overload - 30 Gal.)	225	
(Aux. Engine - 1-1/2		11
Armament		
Nacelle Guns and Ammunition		871
Fuselage Guns and Ammunition		717
Pyrotechnics (Alternate Load)	52	
Bombs (Alternate Load)		
Type T-4	340	
Type M-5	600	
Miscellaneous Equipment		113
Gross Weight		19,000
Wing Loading, Normal Gross Wt. (688 Sq.Ft.)		27.6 Lbs./Sq.Ft.
Power Loading, Normal Gross Wt. (2000 H.P.)		9.5 Lbs./H.P.
Maximum Loaded Weight Safe Flight		21,625





HANDBOOK
OF
OPERATION AND FLIGHT INSTRUCTIONS
FOR THE
MODEL YFM-1A MULTI-PLACE FIGHTER
AIRPLANE
MANUFACTURED BY
BELL AIRCRAFT CORP.
BUFFALO, N. Y.

Cont. W535-AC 11122

Specification Type Y-604, Model Y-604-2

NOTE: These instructions affect safety of flying and a copy of this Technical Order will be placed in the Special Section of the Pilot's Information File prescribed by Air Corps Circular 45-7.



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THREE QUARTER FRONT VIEW - YFM-1A AIRPLANE.

FIGURE 1

SECTION IINTRODUCTION AND REFERENCES

1. This Technical Order is the Operation and Flight Instructions for the Model YFM-1A Multi-Place Fighter Airplane. Pilots and other personnel who are required to understand the operation of these airplanes will read and be familiar with the information contained herein.
2. Reference has been made in this Handbook to the following Technical Orders which contain applicable data and instructions:

T. O. No.	00-25-5	Procedure to be followed in Case of Fires During Flight
	01-1-60	Use of Flaps
	02-1-29	Ground Operation Instructions for Air- craft Engines
	02-5A-1	Operation & Flight Instructions - V-1710-11, -13, -21 & -23 Engines
	03-20BA-1	Operation & Flight Instructions (Curtiss) Automatic & Feathering Type

SECTION IIDESCRIPTION1. Airplane.

a. General. - The YFM-1A Airplane is a mid-wing monoplane, multi-place fighter, powered by two V-1710-23 Allison engines, each driving a pusher propeller. Its overall span is 70 feet, overall length 45 feet 11-3/8 inches, and overall height 19 feet 6 inches.

b. Wing. - The wing is of the stressed skin box type, all metal cantilever construction and is composed of a center and two outer panels, each panel being made up of a box beam, a leading edge and a trailing edge. In the outer panels the wing tips are detachable. The balanced ailerons are constructed of aluminum alloy framework, aluminum alloy fittings, and fabric covering. Each aileron has a controllable trim tab at its inboard end. The flaps are of the split trailing edge type, built in two sections on each side of the fuselage. The outboard section of the flap extends from the aileron to the outboard edge of the nacelle and the inboard section extends from the outboard edge of the nacelle to the fuselage. They are actuated by a manually or electrically controlled landing gear and flap power unit.

c. Empennage. - The horizontal and vertical stabilizers are of all metal construction attached in fixed alignment to the fuselage. The rudder and elevators are of the fabric covered type, dynamically and approximately statically balanced and equipped with trim tabs controllable from the cockpit.

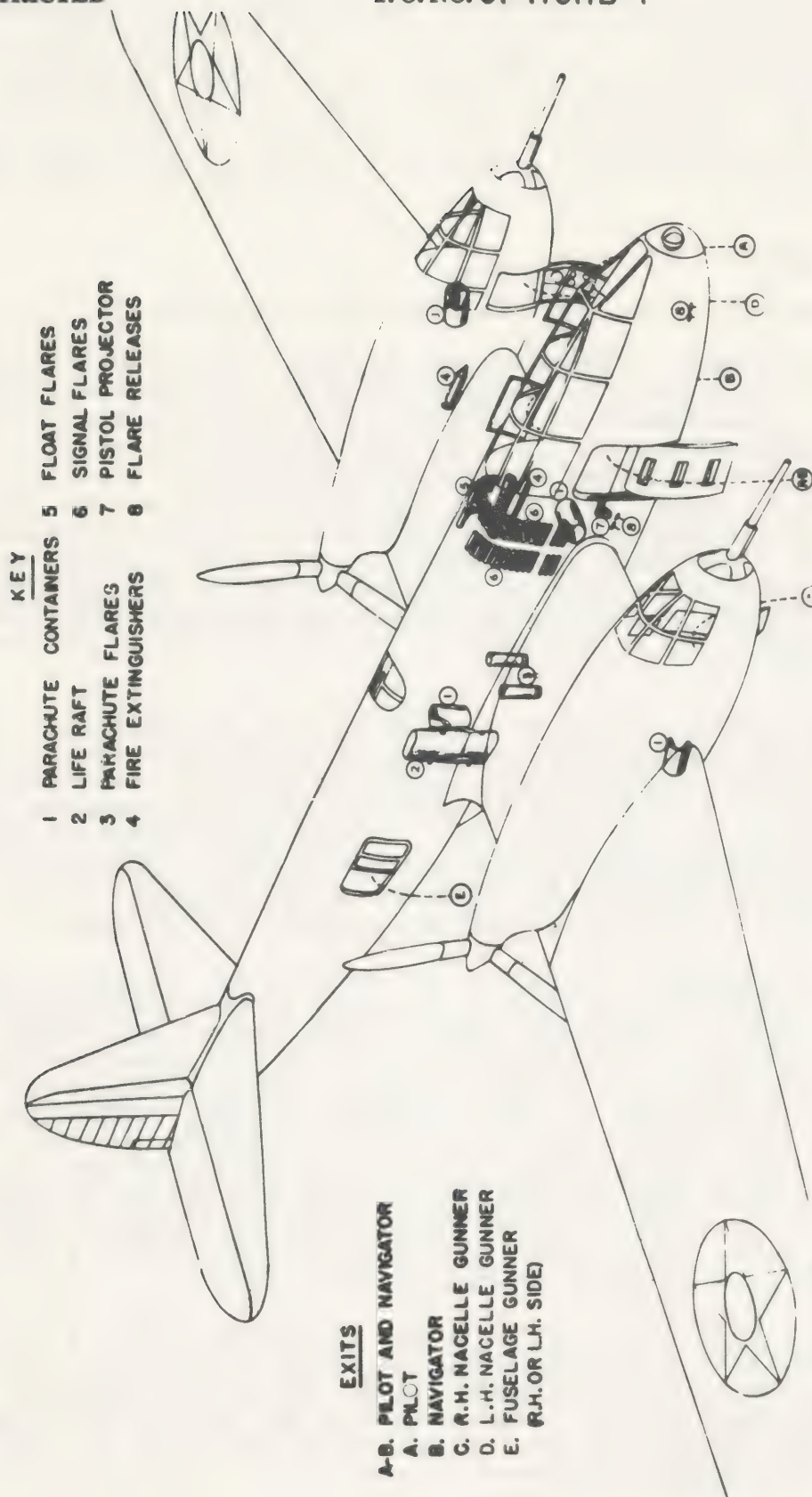
d. Fuselage. - (1) General: The fuselage is composed of nose and tail sections joined at the front wing beam. The tail section is of semi-monocoque construction. Both sections are constructed of frames and bulkheads supported by two longitudinal beams and stiffened by hat-shaped stringers. An enclosed cabin extends from the nose of the fuselage to aft of the navigator's station. A flat shatter-proof glass windshield is provided in front of the pilot.

(2) Emergency Exits: Fall-away sections on the left side of the fuselage cabin enclosure at both pilot's and navigator's stations provide emergency exits. Releases for these sections are located at the top center of each. The fuselage gunner's emergency exit is by means of either side gun turret. The entrance doors on each nacelle constitute the nacelle gunner's exits. Refer to Figure 2.

e. Landing Gear. - The landing gear, main wheels, and nose wheel, are fully retractable. The main wheels draw up and inboard into the under surface of the wing center section. The main wheels are equipped with 39" diameter smooth contour tires and 15" x 4" hydraulic brakes. Brakes are operated by the conventional foot pedals incorporated in the rudder pedals. The parking brake, located

RESTRICTED

T.O. NO. 01-110HB-1



- KEY**
- | | |
|------------------------|--------------------|
| 1 PARACHUTE CONTAINERS | 5 FLOAT FLARES |
| 2 LIFE RAFT | 6 SIGNAL FLARES |
| 3 PARACHUTE FLARES | 7 PISTOL PROJECTOR |
| 4 FIRE EXTINGUISHERS | 8 FLARE RELEASES |

EXITS

A-B. PILOT AND NAVIGATOR

A. PILOT

B. NAVIGATOR

C. R.H. NACELLE GUNNER

D. L.H. NACELLE GUNNER

E. FUSELAGE GUNNER

(R.H. OR L.H. SIDE)

NOTE IN EMERGENCY, PROPELLERS MAY BE FULLY FEATHERED AND STOPPED IN 6(SIX) SECONDS.

FIG. 2-EMERGENCY EQUIPMENT AND EXITS

RESTRICTED

directly in front of the pilot at the lower edge of the instrument panel may be engaged when pedals are depressed and disengaged by again depressing pedals. The nose wheel assembly operates with the main landing gear wheels and includes a shock strut, retraction struts, and a 30" smooth contour tire and wheel. Retraction of the nose wheel is obtained through a broken link and screw arrangement actuated by the electrically and manually driven landing gear and flap control units.

2. Power Plant.

a. Engines. - See Section V for description.

b. Propellers. - Three-blade, constant speed, full feathering, automatic selective pitch, pusher type are provided which may be controlled automatically or manually. When controlled automatically, a predetermined engine speed is held constant by means of a governor set by the propeller control on the throttle quadrant. When controlled by manual selection, the blade angle may be varied by operation of the increase or decrease R.P.M. switch independently of the governor. Emergency fast feathering is assured by a separate switch on the pilot's electric panel which applies, through means of a voltage booster, an increased voltage of approximately three to one to the propeller motors causing the propellers to feather in 6 to 8 seconds.

c. Oil System. - Oil is carried in two 28-1/2 gallon tanks, one located aft of each engine. Cooling is provided by two 12 inch diameter oil coolers equipped with viscosity valves. Additional temperature control is provided by means of manually operated shutters located in the air outlet ducts. Controls for these shutters are adjacent to wobble pump control in the cockpit. Oil dilution for winter flying conditions is obtained by the solenoid valve, control for which is located on the pilot's electrical panel.

d. Fuel System. - Refer to the fuel system diagram, Figure 3. Fuel is carried in tanks with a capacity of 200 gallons each. The two main tanks are on either side of fuselage in the center section of the wing and the auxiliary tanks in the outer panels, out-board of each nacelle. A stand pipe in the left main fuel tank insures 20 gallons of fuel for the auxiliary engine. This fuel is in addition to the normal supply and does not register on the fuel level indicator as it is not available for operation of the main engines. The wobble pump and fuel valves are controlled by push-rods, except for the cross suction valve, located on the cross-over fuel equalizer line. Fuel equalization is thus obtained by the local operation of this valve on the gunner's floor.

e. Auxiliary Power Plant. - The auxiliary engine is an Eclipse M-3701X, 13.5 H.P., two cylinder, four cycle, gasoline engine running at a constant speed of 4000 R.P.M. It is located in the forward section of the fuselage below the floor at the navigator's station. An oil supply tank is located below the floor at the navigator's station, forward and above the auxiliary engine in the fume-tight auxiliary engine compartment.

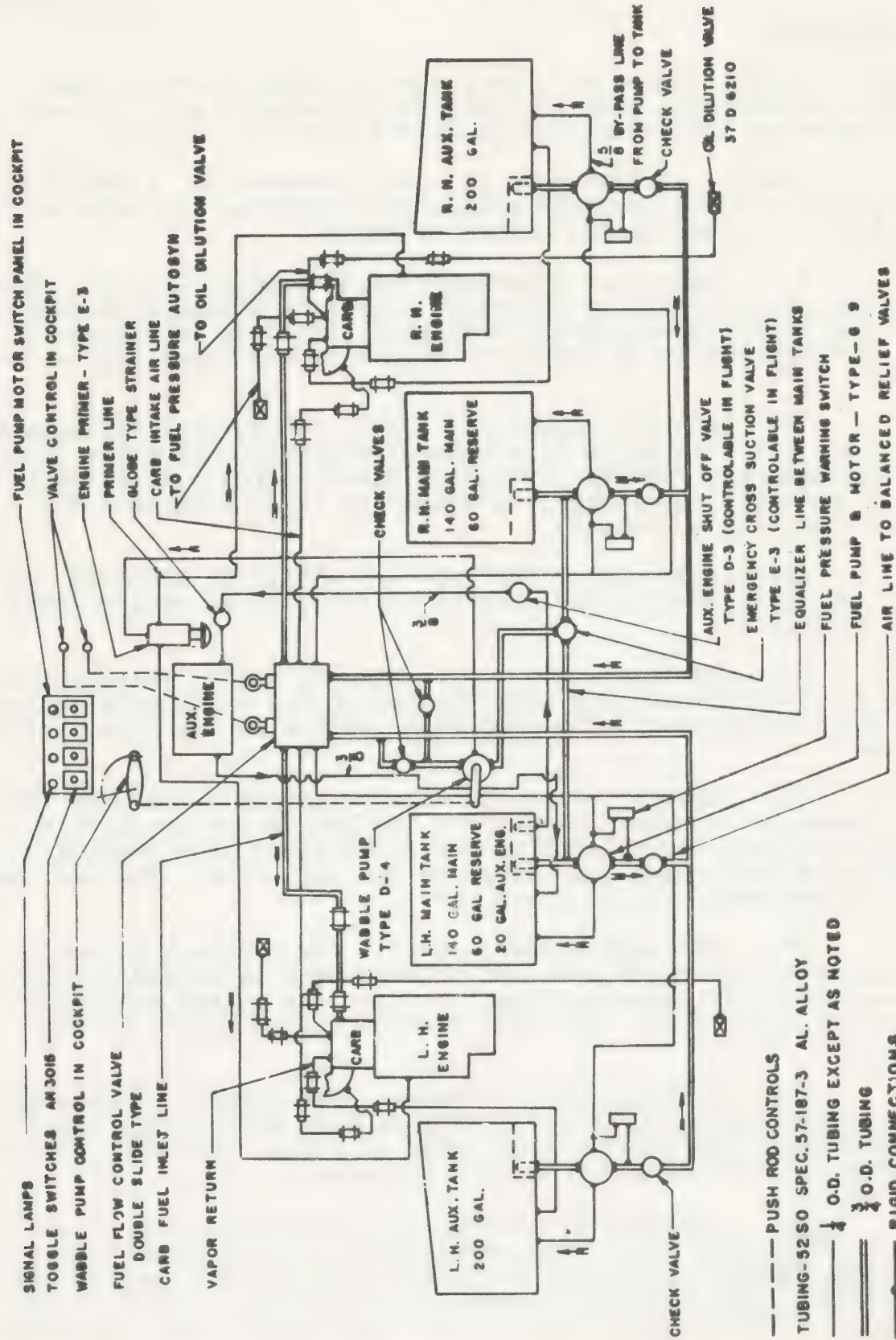


FIG. 3-FUEL SYSTEM DIAGRAM

3. Equipment.

a. Flight Controls. - Dual wheel-column-stirrup flight controls are provided. The stirrups are adjustable and the navigator's stirrups and column may be stowed when not in use.

b. Electrical System. - (1) Main Generator: A model 3718RX Eclipse, single voltage generator delivering 175 amperes at 4000 R.P.M. is driven by the auxiliary engine.

(2) Emergency Generator: A 50 ampere, 24 volt, direct current generator driven by the right engine is arranged to operate in parallel with the main generator, thus providing an emergency source of power supply in event of failure of auxiliary engine or its generator.

(3) Autosyn Converter: Power for Autosyn instruments is obtained from a vibrator type converter located below the floor of the fuselage and forward of the auxiliary engine. An alternate source of power is furnished by a dynamotor located beneath the floor at the pilot's station.

(4) Batteries: Two type C-5 batteries connected in series, supply electric power. Their capacity is 34 ampere hours at five hour rate.

c. Fuselage Equipment. - (1) Pilot's Seat: The pilot's seat is of conventional type with a lever on the right side to permit vertical adjustment. The seat back cushion is the pilot's life preserver.

(2) Navigator's Seat: The navigator's seat has fore and aft movement from the navigator's station to the co-pilot's station, controlled by a lever on the right side. The vertical adjustment is controlled by a lever on the left side. The seat back cushion is navigator's life preserver.

(3) Fuselage Gunner's Seat: The fuselage gunner's bench hinges on the right side and folds upward to stowed position. A release lever is located on the left side. A canvas seat back stows on the right side. The seat cushion is the gunner's life preserver.

(4) Nacelle Gunner's Seats: The nacelle gunners are provided with folding seats having canvas back and bottom. They stow in vertical position on front side of engine firewall. The seat cushion is the nacelle gunner's life preserver.

(5) Parachutes: The pilot is provided with a seat pack parachute. All other crew members use the detachable type. The nacelle gunner's parachute is located beneath his seat on the outboard side. The fuselage gunner's parachute is located in the fuselage on the left side, opposite the life raft. The navigator's

parachute is carried on the rear side of his seat back.

(6) Life Raft: A Type A-2 five-man life raft complete with CO₂ cylinder is carried on the right side of the fuselage aft of the top gun turret. Inflation is by manual operation of the valve on the raft itself.

(7) Baggage Space: Adequate space for baggage is provided in the fuselage below the floor, forward of the bottom turret gun compartment.

d. Fire Extinguishing Equipment. - (1) General: For procedure to be followed in case of fire during flight refer to T. O. 00-25-5.

(2) CO₂ Type Fire Engines: A Type A-12 CO₂ extinguisher is mounted in the forward part of the fuselage under the floor. The control pull and selector valve are located on the pilot's electrical panel.

(3) Hand Type: One Type A-14 extinguisher is located in the fuselage above the wing crawlway to the left rear of the navigator. One Type A-2 extinguisher is located in the left landing gear wheel well, accessible from the ground.

e. Flotation Equipment. - Four built-in interconnected watertight compartments within each wing outerpanel provide flotation in event of emergency water landing. Vent and bilge lines run from these compartments to the top outboard side of each nacelle. A bilge pump carried in the fuselage over the bomb compartment should be used at each bilge connection after emergency landing on water.

f. Oxygen Equipment. - The oxygen equipment consists of one Type E-1 oxygen cylinder and one Type A-6 regulator for each station.

g. Communication Equipment. - The radio is a Type SCR-261 command set. The control box is located below the instrument panel and directly in front of the pilot. An antenna loop is installed in an enclosure in the nose of the airplane and a fixed antenna runs from the top of the forward section of the fuselage to the top of the leading edge of the fin. The airplane is equipped with a 5-place interphone system with units located on right side at each station.

h. Heating and Ventilating Equipment. - Warm air is brought to each crew station through ducts from a heater muff around the exhaust manifold of each engine. Butterfly valves at each station control the warm air flow to suit individual requirements. Pilot's and navigator's stations are ventilated by means of sliding panels in either side of the cabins enclosure. The nacelle gunner's compartment is similarly ventilated.

i. Bombing Equipment. - Twenty Type T-5 or Type M-5 bombs, are carried in the fuselage between the front and rear beams of the wing center section. Bomb compartment doors are of the manually operated type.

j. Gunning Equipment. - (1) Nacelle Guns: Each nacelle accommodates one Colt 37 mm automatic cannon operated by electrical motors and controlled locally by electrical hand control or from electric fire control box at navigator's station. The trigger is located on the hand control box. Selection of control is obtained through a distributing switch in each nacelle. The cannon is limited to an effective 25° cone of fire by limit switches provided. Eleven ammunition boxes, each containing two clips of five rounds, are located in the gunner's station of each nacelle. When fixed gun firing position is preferred the guns may be set manually by removing the hand crank from the distributing switch and inserting it on the aft ends of azimuth and elevation motors. Removal of 37 mm cannon allows installation of Type H-2 gun cameras.

(2) Fuselage Top Turret Gun: The .30 caliber Type M-2 machine gun rides in a retractable 360° full swiveling turret located on the top of fuselage just forward of the trailing edge of the wing. The gun is of the shoulder firing type and will elevate to a straight up position. A stop prevents firing into the pusher propellers. The turret is lowered and elevated by means of a crank on the left side of the fuselage. Five L-4 ammunition boxes containing 500 rounds of .30 caliber ammunition are located on the right side of the fuselage at approximately the center of the station.

(3) Fuselage Side Turret Guns: The side turret gun installations, located on both sides of the fuselage between the wing and the tail, each consist of a manually retracted turret, a door hinging aft and inboard, a .50 caliber Type M-2 machine gun mounted in a shoulder fire adapter and 1200 rounds of ammunition in Type O1 ammunition boxes. These ammunition boxes are located on the side of the fuselage just ahead of each turret. Just above and aft of these ammunition boxes is a crank for extending and retracting the turret. At the bottom of the splined post is a handle lock for vertical adjustment of the gun mount and midway on the gun support arm is a lock release for rotational adjustment. The guns are held in stowed position by clips located on the floor on either side of the station.

(4) Fuselage Bottom Turret Gun: The bottom turret gun installation consists of one .30 caliber Type M-2 machine gun mounted in a Type C-12 flexible gun adapter and a 180° rotatable turret located in the belly of the fuselage just forward of the side turret guns station. A turret rotation release is located on the left side of the station. Five Type L-4 ammunition boxes containing 500 rounds of .30 caliber ammunition are provided on the gunner's left as he faces aft.

k. Pyrotechnic Equipment. - A Type M-2 signal pistol is at the right side of the navigator, and 15 white and 15 red flares are also at the right side of the navigator above longerons. Two Type M-8 flares, installed in Type A-4 racks, aft of rear beam at gunner's floor, are controlled by two handles on the right side of the floor of the pilot's compartment and two on the right side of floor of the navigator's compartment.

SECTION IIIGENERAL INSTRUCTIONS

1. Location of Controls.

For location of controls refer to Section II and to Figures 4 to 7 inclusive.

2. Operation of Controls.

a. Flight Controls. - (1) General: Operation of the dual wheel-column-stirrup flight controls is conventional. When not in use the navigator's control column is stowed along left side of fuselage. To bring column into use detach from stowage clip and rotate forward to normal position. Navigator's rudder pedals are stowed beneath floor when not in use. When needed, open spring loaded doors and bring pedals into position. To adjust pedals, press forward on spring loaded lever on the outer side of the pedals to allow pedals to move forward. To return pedals, insert toe under pedal and pull back. There are five positions where pedals may be locked.

(2) Trim Tabs: Trim tab control units are located on the fuselage floor, one at the pilot's left and the other at the navigator's left. Each unit contains knobs for operating the rudder and aileron tabs; and a lever for operating the elevator tab. Trim tabs are for trimming only and are not to be used for balance.

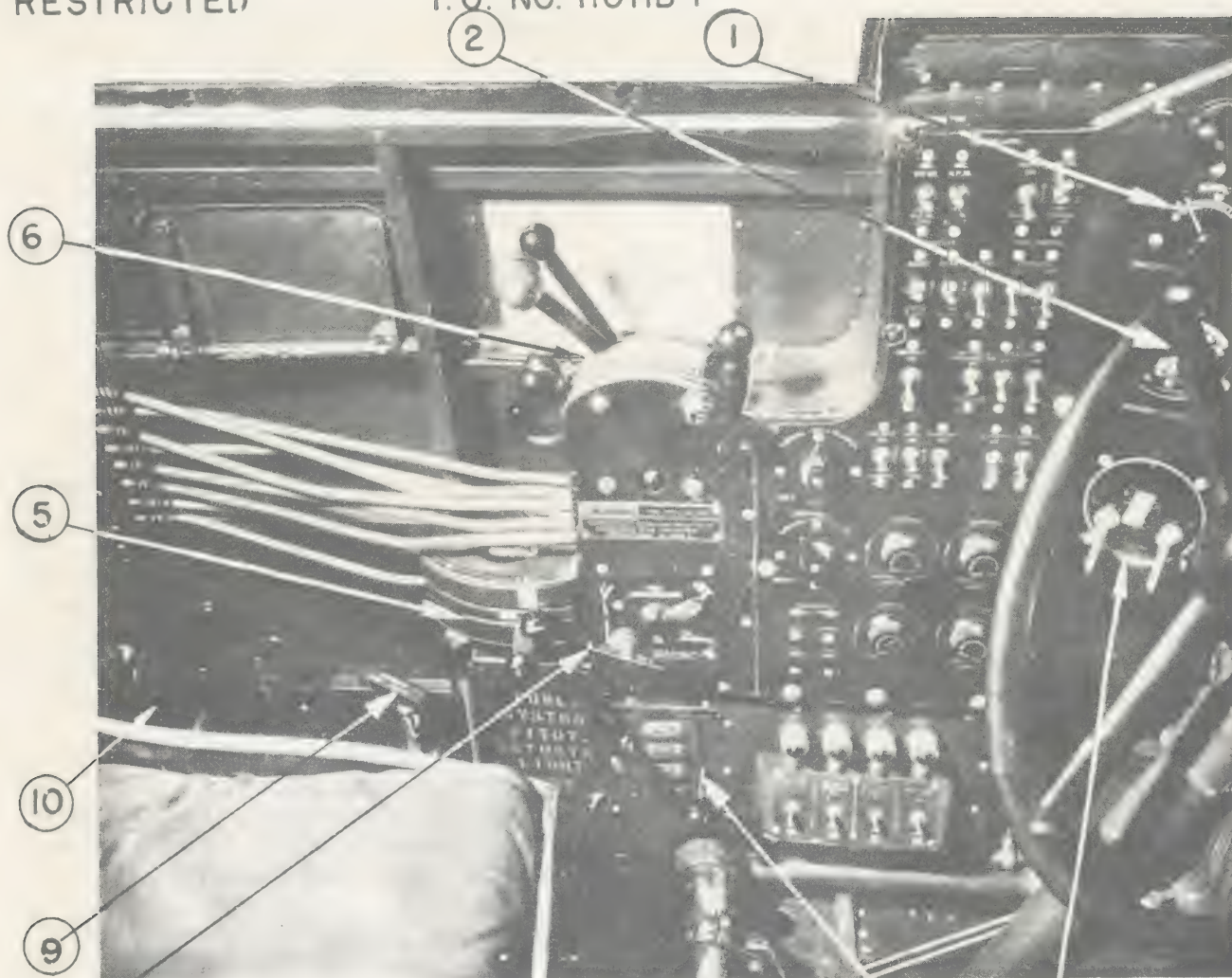
(3) Flaps: For operation of the flaps see paragraph b. below and T. O. 01-1-60.

b. Landing Gear Controls. - (1) General: The landing gear and flaps are operated in conjunction with each other. The master switch, shown on Figure 7, should be in the "ON" position at all times during the operation of the airplane except when selecting intermediate flap positions as in (2) below. Refer to illustration of the Control Box, Figure 7.

(2) Landing: To operate for landing, turn selector switch to "LAND". The landing gear and nose wheel will extend first, as shown by the landing gear and nose wheel indicator. When the landing gear and nose wheel are completely extended, the flaps will extend automatically to 40 degrees "DOWN". Any degree of flap deflection may be selected by moving master switch to "OFF" position when flaps are at the desired deflection. This may be done as soon as the landing gear warning horn indicates that the wheels are down. When the master switch is moved to the "ON" position, the flaps will continue down.

RESTRICTED

T.O. NO. 110HB-1



- 1 EMERGENCY GENERATOR AMMETER
- 2 ACCESSORY GENERATOR AMMETER
- 3 IGNITION SWITCH, TYPE B-4A
- 4 ANTENNA AMMETER
- 5 SUPERCHARGER CONTROL
- 6 ENGINE CONTROLS UNIT
- 7 FIRE EXTINGUISHER (CO₂)
- 8 FUEL SELECTOR VALVES
- 9 EMERGENCY BOMB RELEASE
- 10 TRIM TAB CONTROL UNIT

FIGURE 4 — PILOTS COCKPIT ARRANGEMENT & CONTROL —
LEFT SIDE



1. FLARE RELEASE HANDLES
2. PRIMER
3. ANTI-ICER CONTROL (PROP)
4. ANTI-ICER SWITCH (PROP)
5. SUCTION GAGE, TYPE F-2
6. VACCUM SWITCH
7. FUEL PRESSURE WARNING LIGHTS
8. OXYGEN REGULATOR, TYPE A-6

FIGURE 5 - PILOTS COCKPIT ARRANGEMENT & CONTROLS -
RIGHT SIDE

(3) Take-Off: Upon landing, rotate selector switch to "TAKE-OFF" position to retract flaps. This operation engages a brake on the landing gear, eliminating possibility of wheel retraction while airplane is on the ground.

(4) Fly: After take-off, the landing gear is retracted by moving selector switch to "FLY" position.

(5) Manual Operation: To manually extend the landing gear and flaps insert hand crank into slow speed socket, located in the center of the carry-thru deck, and crank until high handle loads have been eliminated, then shift to high speed socket and proceed until landing gear and flaps are extended. The high speed socket will lower the gear three times as fast as the slow speed socket.

c. Power Plant Controls. - (1) General: Operation and Flight Instructions for the Allison V-1710-23 engines are contained in T. O. 02-5A-1 and also in T. O. 02-1-29 on the ground operation of aircraft engines.

(2) Starting Engines: Starting will be accomplished in accordance with T. O. 02-5A-1, except for the following special instructions.

(a) Place master ignition switch (in center of main engine ignition switch) in "ON" position, and start auxiliary engine according to Paragraph (8) below.

(b) Place engine selector valve handle in "ON" position for engine to be started.

(c) Place mixture control handle of engine to be started in "IDLE CUT-OFF" position.

(d) Turn on autosyn dynamotor.

(e) Check fuel level indicator fuel supply in tanks.

(f) Place fuel pump switch of tank desired on "ON" position. Left main tank should be used for starting left engine and right main tank for right engine. If the engine is to be started from tank on opposite side of airplane both fuel selector valves must be placed in "CROSS FEED" position and mixture control lever of engine not running placed in "IDLE CUT-OFF" position to prevent electric driven fuel pumps from flooding engines.

(g) Prime engine to be started two to four times if engine is cold, otherwise no priming is necessary.

(h) As starter is meshed, throw mixture control lever into "RICH" position. No wobble pump operation is necessary with electric driven fuel pumps.

(i) If engine does not start, return to "IDLE CUT-OFF" position immediately to prevent flooding.

(j) If engine floods, repeat starting operation as above, but leave mixture lever in "IDLE CUT-OFF" position until engine catches. Then place in "RICH" position.

(3) Stopping Engines: The engines will be stopped in accordance with T. O. 02-1-29. An "IDLE CUT-OFF" is provided. T. O. 02-1-29 also contains operation instructions for the oil dilution system.

(4) Propeller: For automatic constant speed control, throw switches to automatic and follow instructions below. Further operation instructions are given in T. O. 03-20BA-1.

(a) For take-off set propeller controls on throttle quadrant to 2950 R.P.M.

(b) During flight set propeller controls on throttle quadrant to desired R.P.M.

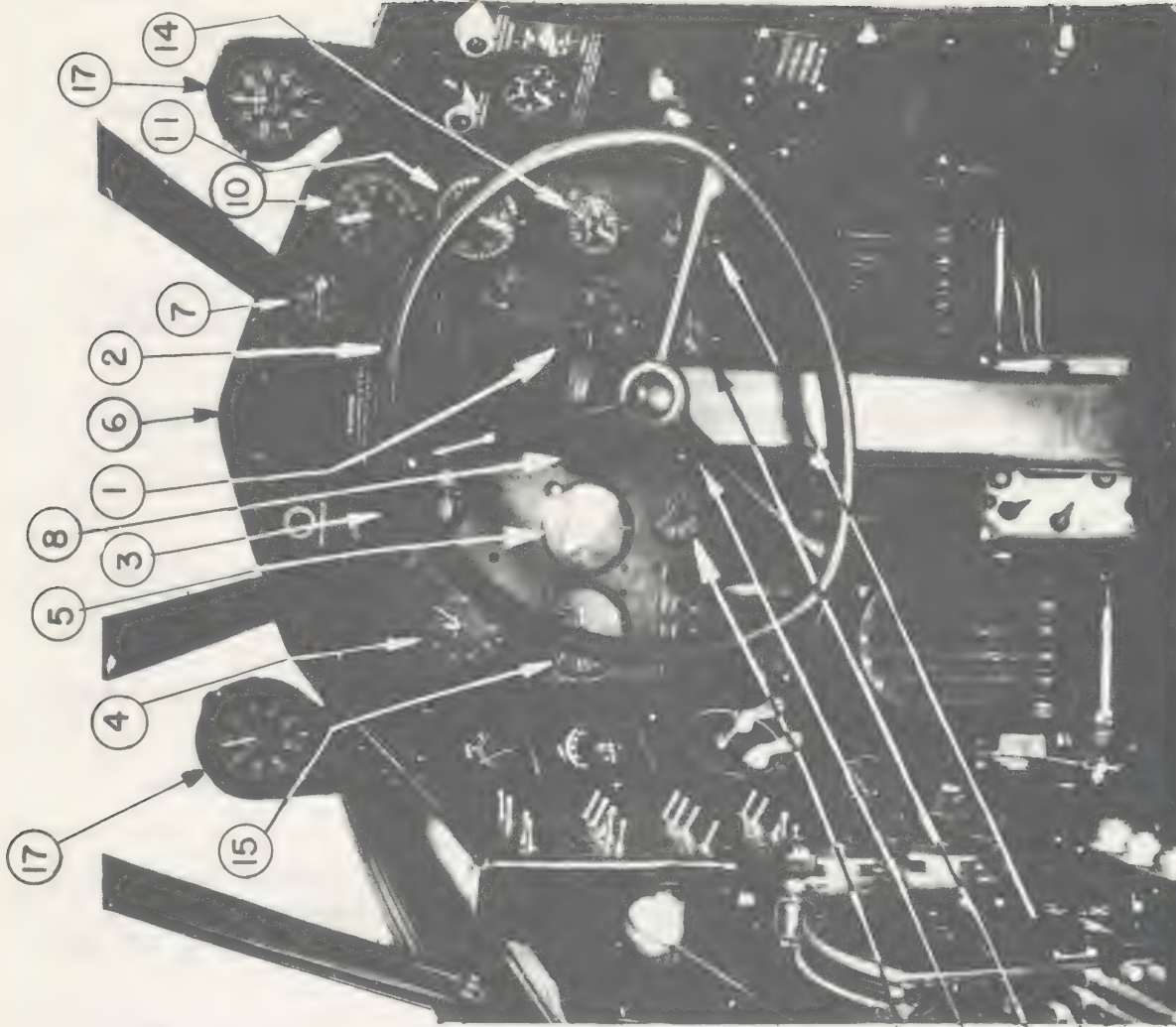
(c) For landing set propeller controls on throttle quadrant for 2000 to 2400 R.P.M. In any case, the speed should be sufficiently below take-off R.P.M. to prevent overspeeding of the engine in case a sudden burst of power is applied.

(d) For manual control throw switches to "MANUAL" and operate switches marked "INCREASE AND DECREASE R.P.M."

(e) For feathering move red control switches to forward position marked "FEATHER".

(f) Move propeller control forward to increase R.P.M. and aft to decrease R.P.M. The markings on the propeller control are approximate and the desired R.P.M. should be obtained by relying on the tachometer.

(5) Fuel System: The fuel system control panel on the left side of the pilot's cockpit consists of an "OFF" and "ON" switch, a test switch, and a fuel pressure signal lamp for each of the four electrically driven fuel pumps. A fuel reserve lamp which indicates when the reserve fuel is being used is located just below the fuel level indicator on the left side of the main instrument panel. The primer is located at the pilot's right. Tanks are selected by electric switches near pilot's left leg. Engine selector valves are operated by push-pull handles just above pilot's left arm. A hand operated fuel pump is provided.



1. RATE OF CLIMB IND., TYPE A-6
2. FLIGHT INDICATOR, TYPE C-4
3. TURN INDICATOR, TYPE A-3
4. ALTIMETER, TYPE C-10
5. AIRSPEED IND., TYPE D-4
6. COMPASS, TYPE B-16
7. CLOCK, TYPE A-7
8. TURN & BANK, TYPE A-5
9. AIR THERMOMETER, TYPE C-6
10. MANIFOLD PRESSURE GAGE (DUAL) PIONEER 5018-1E-A
11. TACHOMETER (DUAL) AUTOSYN PIONEER 5018-16G-A
12. OIL TEMP. INDICATOR (DUAL) AUTOSYN PIONEER 5214-4A-A
13. OIL PRESSURE GAGE (DUAL) AUTOSYN PIONEER 5214-3A-A
14. FUEL PRESSURE INDICATOR AUTOSYN PIONEER 5214-2A-A
15. FUEL LEVEL INDICATOR PIONEER 5019-24A-A
16. PRESTONE TEMP. IND. (DUAL) PIONEER 5214-4B-A
17. MANIFOLD PRESSURE GAGE (TEMP. INSTALL.)

FIGURE 6 PILOTS COCKPIT ARRANGEMENT AND CONTROLS - CENTER

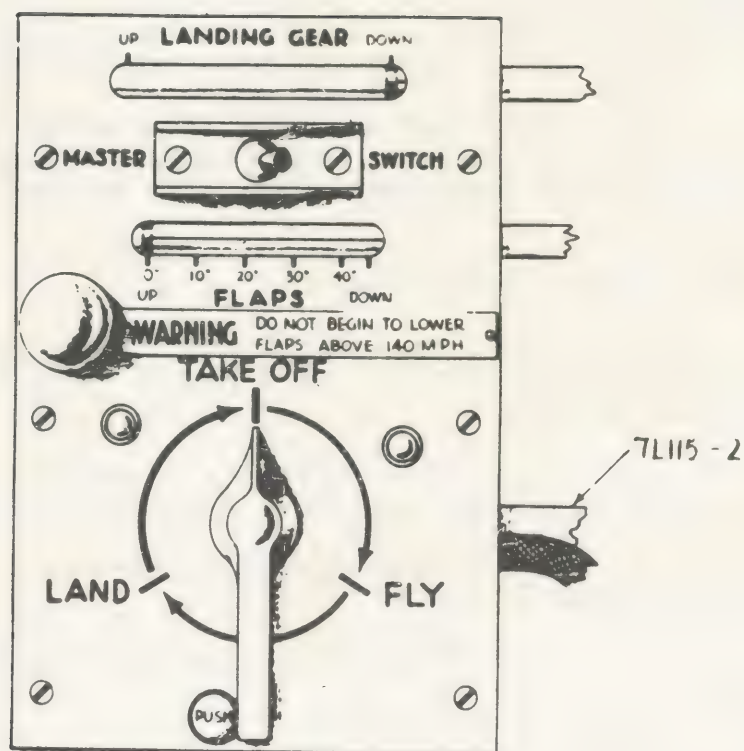


FIG. 7-LANDING GEAR AND FLAP CONTROL BOX

(6) Cooling System. - (a) Prestone Radiator Shutter Controls: Manual control is on fuselage floor at pilot's left.

(b) Oil Cooler Shutter Controls: Move forward to open and aft to close.

(7) Superchargers: A Type A-7A supercharger regulator is installed for each supercharger. The regulator line is attached to the exhaust manifold to eliminate surging. Because of this, the supercharger control handles in the cockpit must be pulled back as the airplane gains altitude to prevent excessive boost. The supercharger controls are located at the pilot's left.

(8) Auxiliary Engine: To operate auxiliary engine place fuel valve located at rear of wing carry-thru on right side of airplane in "ON" position and proceed as follows:

(a) Move master switch in center of main ignition switch to "ON" position.

(b) Move auxiliary engine ignition switch on navigator's panel to "BOTH". This switch is safetied through the main ignition switch.

(c) Move "Start - Generate" switch to "START" position until engine starts, then release switch.

(d) Move ignition switch to "IDLE" for warm up period - then back to "BOTH".

(e) To stop engine move ignition switch to "OFF" position.

d. Other Controls. - (1) Master and Ignition Switches: These switches are on the pilot's electrical control panel. The master switch is located directly above the left and right engine ignition switches and other than controlling the ignition, this master switch also controls all those circuits that are safetied through it, namely; the starter circuits, the pitot heater circuit, the fuel pressure warning circuits, the auxiliary engine ignition and fuel pump electrical circuit. This switch should always be thrown to "OFF" position before leaving the airplane.

(2) Pitot Heater: A switch on the pilot's electrical panel controls the heating element in the pitot tube.

(3) Warning Bell: Warning bells at each crew station are operated by a switch on the pilot's control panel.

(4) Ice Eliminating Systems: (a) Leading Edge De-Icer: A Motor operating the de-icer distributing valve is controlled by a switch on the pilot's right hand auxiliary panel. This panel also contains one double pole switch controlling solenoid

switches which directly control motors on vacuum pumps located in the auxiliary engine compartment.

(b) Propeller Anti-Icer: The propeller anti-icer system is separate from the wing de-icing system. The control is on the panel to the pilot's right.

(5) Gunning Equipment. - (a) Top Turret Gun: To operate the top turret gun perform the following operations in sequence.

1. Remove turret slot cover.
2. Release gun barrel from spring clip by rotating gun barrel upwards.
3. Unlatch gun mount by pressing lever at butt end of gun mount, and fold gun down inside of turret.
4. Extend turret by operating hand crank on left side of airplane.
5. Extend gun through turret slot and latch gun mount by engaging the taper pin, top hole for operating position, bottom hole for stowed position.

(b) Side Turret Guns: To operate the side turret guns proceed as follows:

1. Release catch.
2. Extend the turret by operating the turret retraction and extension crank.
3. Remove the gun barrel from stowage clip.
4. Swing turret door inboard and aft to holding clip provided.
5. Release vertical adjustment of opposite lock by turning handle and raise opposite gun mount to the top position.
6. Release rotation lock and swing gun forward and up.
7. Release vertical adjustment and raise gun.

(c) Belly Gun Turret: To operate the belly gun turret, pull turret release lock and rotate turret to top locked position. Break gun from stowage clip and swing into firing position.

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(d) Radio and Interphone. - 1. Radio: The control panel is located on the fuselage floor forward of the pilot's control column at centerline of airplane.

2. Interphone: Each interphone station contains a rheostat volume control.

SECTION IVSPECIAL INSTRUCTIONS

1. Flight Limitations.

a. Maneuvers Prohibited.

Loop
Roll
Immelmann
Inverted Flight
Spin

b. Other Restrictions. - (1) Do not exceed a speed equal to the indicated high speed multiplied by 1.225.

(2) Do not exceed an indicated airspeed of 140 M.P.H. with flaps down.

(3) The maximum permissible position acceleration is 5.6 G. The maximum permissible negative acceleration is 1.6 G.

2. Engine Cooling System.

The engines should not be allowed to idle for a long period of time on the ground as the cooling system is designed for efficient cooling in flight only. Maximum allowable temperature of prestone before take-off is 125°C. (257°F).

3. Landing Gear.

The pilot should be thoroughly familiar with the operation of the landing gear. Care should be taken that the selector switch is either on "LAND" or "TAKE-OFF" before operating the landing gear and flap control master switch, while the airplane is on the ground.

4. Warning.

Due to close proximity of propeller to tail surfaces, a sudden reduction of power of one engine either through an engine failure or excessive movement of one throttle will result in a much more violent and immediate control reaction than on multi-engine tractor type airplanes. Failure of one engine may result in a spin unless the other engine is retarded or trim tab control adjusted immediately. In case of failure of one engine the other engine should be retarded immediately and the throttle of good engine advanced gradually as trim tab control is adjusted to counteract turning moment. With proper adjustment of trim tab, airplanes can be safely flown on one engine. Single engine practice flights will not be engaged in below ten thousand feet. This airplane should be flown only by experienced multi-engine pilots.

SECTION VPOWER PLANT

1. Engine.

a. General. - The YFM-1A Airplane is powered with two Allison V-1710-23 prestone cooled Vee type engines driving three bladed pusher propellers through short extension shafts. The engines are normally operated on 100 Octane fuel, and have a compression ratio of 6.65:1, an engine blower gear ratio of 6.23:1 and propeller reduction gear ratio of 2:1.

b. Ratings.

Normal	(Sea Level)	1000	B.H.P.	2600	R.P.M.
Take-Off	(Sea Level)	1150	B.H.P.	2950	R.P.M.
Military	(Sea Level)	1150	B.H.P.	2950	R.P.M.

c. Supercharger. - A Type B-1 exhaust driven turbo-supercharger is installed in the bottom surface of the wing under each nacelle. The turbine element is driven by the engine exhaust gases, which pass through the supercharger and are discharged from the bottom. Air for the carburetor is taken into the supercharger air inlet, compressed and passed through the intercooler, and brought to the carburetor, where it is mixed with gasoline and led through the engine blower to the cylinders.

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SECTION VIIWEIGHT DATA

1.	<u>Weight in Pounds</u>	<u>Overload</u>	<u>Normal</u>
	Weight Empty (Includes radio)		13,674
	Useful Load		5,326
	Crew: (5 at 200# each)		1,000
	Fuel: (Normal) 400 gal.		2,400
	Fuel: (Overload) 400 gal.	2,400	
	Oil: (Normal) 28-1/2 gal.		214
	(Overload) 30 gal.	225	
	(Aux. Engine) 1-1/2		11
	Armament		
	Nacelle Guns and Ammunition		871
	Fuselage Guns and Ammunition		717
	Pyrotechnics (Alternate Load)	52	
	Bombs (Alternate Load)		
	Type T-4	340	340
	Type M-5	600	600
	Miscellaneous Equipment		113
	Gross Weight		19,000
	Wing Loading, Normal Gross Wt. (688 Sq. Ft.)		27.6
		Lb. per Sq. Ft.	
	Power Loading, Normal Gross Wt. (2000 HP)		9.5
		Lt. per B.H.P.	
	Max. Loaded Weight, Safe Flight		21,625

BACK COVER - FLYING VIEW OF BELL XFM-1 MULTI-PLACE FIGHTER .
NOT A SUCCESSFUL DESIGN, THERE WAS BUT ONE XFM-1 BUILT. AN
ADDITIONAL NINE YFM-1, AND THREE YFM-1A AIRPLANES WERE BUILT.
THE TWO YFM-1B AIRPLANES WERE CONVERTED FROM THE YFM-1 WITH
AN ENGINE CHANGE.

